Infected renal artery pseudoaneurysm and mycotic aortic aneurysm after percutaneous transluminal renal artery angioplasty and stent placement in a patient with a solitary kidney

Jonathan S. Deitch, MD, Kimberly J. Hansen, MD, John D. Regan, MD, John M. Burkhart, MD, and John Ligush, Jr., MD, *Winston-Salem, N.C.*

Endovascular infections after percutaneous transluminal renal angioplasty with stenting (PTRAS) are rarely reported. Because strict longitudinal follow-up of patients undergoing PTRAS is lacking, the true incidence of such complications remains obscure. We report the first case of a patient with an infected renal artery pseudoaneurysm and de novo mycotic aortic aneurysm after PTRAS. This case serves to illustrate several important points, including (1) the retrieval of renal function in patients with renal artery occlusion, (2) the pathogenesis of infection after PTRAS, (3) the diagnosis and management of endovascular infection after percutaneous vascular intervention, and (4) recommendations for periprocedural antibiotic prophylaxis during PTRAS. (J Vasc Surg 1998;28:340-4.)

Percutaneous transluminal angioplasty (PTA) has been widely applied to numerous vascular beds with varying degrees of success. Patency rates after PTA with residual hemodynamically significant gradients have improved with the addition of stent placement (PTAS). Complications associated with PTAS are for the most part limited to technical failures or hemorrhage. Until recently, reports of infectious complications from PTA have appeared sporadically,[1-4] and it is generally assumed that these procedures are rarely associated with major endovascular infections. Because strict longitudinal follow-up of patients undergoing PTA procedures is lacking, the true incidence of such complications remains ill defined.

As the application of PTA has broadened, percutaneous transluminal renal angioplasty and stenting (PTRAS) has become widely applied to the treatment of main renal artery disease causing renovascular hypertension, ischemic nephropathy, or both. Failures associated with PTRAS are usually reported as failures in primary patency rates with recurrent hypertension and renal artery dissections and occlusions with resultant kidney loss, but only rarely are infectious complications reported.[5]

We describe what we believe to be the first case of a mycotic aortic aneurysm and infected renal artery pseudoaneurysm in a patient with a solitary kidney who was treated with PTRAS for renal salvage. Successful treatment of this life-threatening complication required an operative approach aimed at debridement of infected tissue and restoration of blood flow to the solitary kidney and lower extremities. Aggressive operative management not only was life saving but also controlled sepsis, maintained renal function, and allowed limb salvage.

CASE REPORT

The patient was a 72-year-old white woman. Her past medical history was significant for hypertension and coronary artery disease. She had undergone a left nephrectomy for complications of nephrolithiasis 30 years earlier.

The patient presented to the Wake Forest University School of Medicine with volume overload, mental status changes, and acute renal failure of an undetermined etiology (serum creatinine, 7.1 mg/dl; the most recently documented creatinine level 6 months earlier was 1.1 mg/dl). She was intubated, and a temporary, percutaneous internal jugular dialysis catheter was placed for urgent dialysis. At no period was the patient hypertensive.

From the Divisions of Surgical Sciences (Drs. Deitch, Hansen, and Ligush), Radiology (Dr. Regan), and Nephrology (Dr. Burkhart), Wake Forest University School of Medicine.
Reprint requests: John Ligush, Jr., MD, Division of Surgical Sciences, Wake Forest University School of Medicine, Medical Center Boulevard, Winston-Salem, NC 27157.

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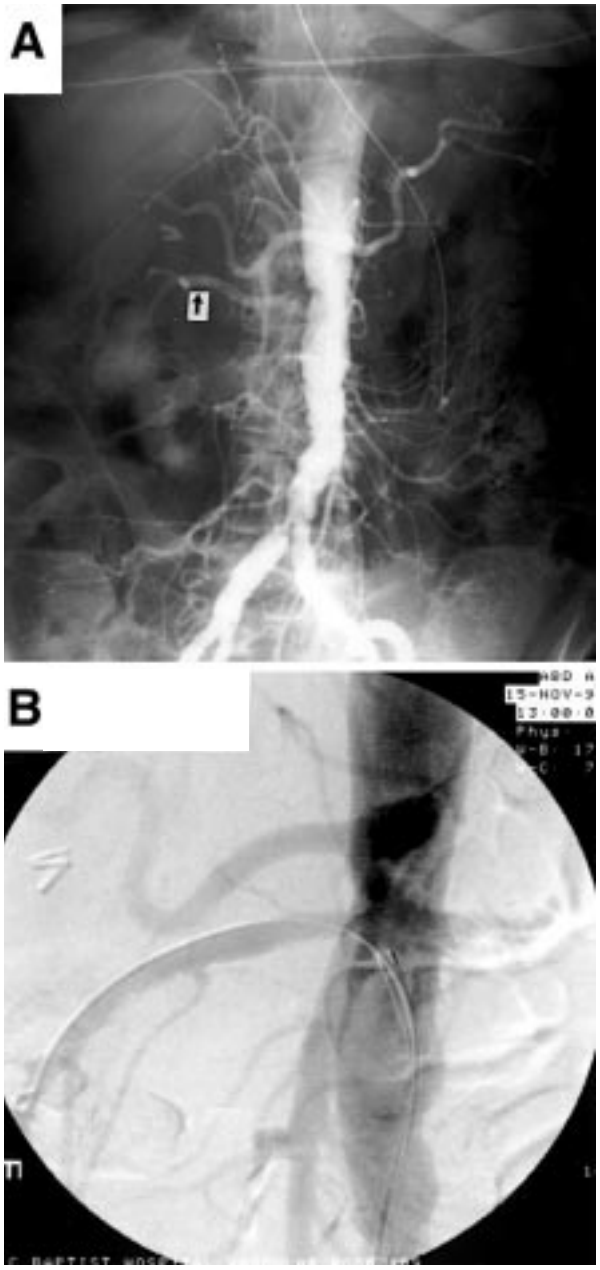

Fig. 1. A, Angiogram showing right renal artery occlusion with distal arterial reconstitution (*arrow*). B, Completion angiogram after right PTRAS.

A renal artery duplex scan revealed occlusion of the renal artery to the 10.5 cm solitary right kidney. The duplex findings were confirmed angiographically (Fig. 1A).

The patient underwent PTRAS of her solitary kidney (Fig. 1B). Despite the lack of antecedent severe hypertension, her creatinine level normalized to 1.1 mg/dl over a period of 10 days. Her hospital stay was complicated by an episode of methicillin-resistant *Staphylococcus aureus* (MRSA) line sepsis from the hemodialysis catheter. She

Fig. 2. Abdominal CT scan showing periaortic fluid collection, renal artery pseudoaneurysm, and de novo aortic aneurysm.

was treated by catheter removal and a 2-week course of intravenous vancomycin.

Four weeks later, the patient was admitted to a local hospital with complaints of lower back pain and malaise. Blood cultures obtained at that time revealed MRSA, and she underwent a 6-week course of vancomycin antibiotic therapy. An abdominal CT scan was performed and failed to show an intraabdominal focus for her bacteremia.

She recovered from this episode but presented 8 weeks later with another episode of bacteremia, a rise in her serum creatinine level to 1.4 mg/dl, and complaints of severe back pain. Laboratory analysis revealed a white blood cell count of $14.9 \times 10^3/\mu L$, hematocrit of 37%, albumin level of 3.0 G/dL and a erythrocyte sedimentation rate of 112. A repeat abdominal CT scan was performed (Fig. 2), which revealed a large paraaortic collection of fluid at the level of her right renal artery and a new

Fig. 3. Angiogram showing renal artery pseudoaneurysm and mycotic aortic aneurysm.

3 cm aneurysm in the juxtarenal aorta. A tagged white blood cell scan revealed an area of intense enhancement at the juxtarenal aorta. The presumptive diagnosis was made of an infected pseudoaneurysm of the renal artery and mycotic aneurysm of the aorta. An aortogram confirmed the presence of a pseudoaneurysm of the right renal artery and the new aneurysm of the juxtarenal aorta (Fig. 3).

The patient was taken to the operating room, where first an 8 mm bifurcated polytetrafluoroethylene axillobifemoral bypass graft operation was performed. The patient was prepped again and explored through a Chevron abdominal incision. A hepatic artery–to–right renal artery bypass was planned, but pulses in the celiac distribution were diminutive despite a normal angiographic appearance on both anteroposterior and lateral projections. Intraoperative duplex scanning confirmed an elevated systolic velocity with poststenotic turbulence at the celiac take-off. A bypass graft operation then was performed from the supraceliac aorta to the right renal artery using 6 mm polytetrafluoroethylene (for lack of a suitable autogenous conduit). Next, the superior mesenteric artery and celiac artery were controlled, and the aorta was clamped above the celiac axis but below the take-off of the renal bypass graft. The distal aorta was clamped above the inferior mesenteric artery. The proximal right renal artery, including the stent, and mycotic aortic aneurysm were excised. At the base of the resection were three exposed lumbar bodies with eroded disk spaces. Cultures were obtained, and the surrounding tissues were widely debrided. The proximal aorta was closed just below the superior mesenteric artery with two layers of polypropylene suture. The distal aorta was similarly closed, and the area was packed with a vascularized pedicle of omentum.

The patient was extubated on postoperative day 1 and discharged on postoperative day 12. Her renal function remained stable postoperatively with discharge blood urea nitrogen and creatinine levels of 11 and 0.8 mg/dl, respectively.

Although intraoperative cultures showed no growth at 7 days, the patient remained on intravenous vancomycin for a total of 6 weeks and has been continued on oral antibiotics. Repeat CT scans at 3 and 6 months reveal no evidence of recurrent infection or pseudoaneurysm. She continues to ambulate without difficulties and has normal renal function.

DISCUSSION

Endovascular treatment of renal artery stenoses, occlusions, and dissections by PTRAS has become a useful adjunct in the treatment of renovascular occlusive disease.[6-9] The procedure has application for carefully selected atherosclerotic lesions and

medial fibrodysplasia involving the main renal artery.[10] More recently, reports of successful percutaneous management of renal artery occlusions[11] and ostial lesions with renal artery stents have appeared in the literature.[12]

Complications related to metallic stenting after angioplasty in the renovascular bed have been reported, but they usually involve atheroembolism, occlusion, hemorrhage, or deployment difficulties. These complications appear to be inherent to the stenting of peripheral vascular, cardiovascular, cerebrovascular, and renovascular systems. Although it is said that infection after PTA is an uncommon occurrence,[5] the increasingly wider application of endoluminal stents to various arterial beds has resulted in scattered reports of infectious complications associated with this procedure.[1-4] The detection of this sometimes insidious problem requires a high level of clinical suspicion and aggressive treatment; late recognition of these infectious sequelae can result in death.[2] Although infection of a perinephric fluid collection after PTRAS has been reported,[5] our case represents the first reported PTRAS procedure resulting in an infected renal artery pseudoaneurysm and mycotic aortic aneurysm.

The pathogenesis of the arterial infection in this patient almost certainly occurred during the PTRAS periprocedural period. PTA results in the deposition of arterial platelets and thrombi, which may potentiate a local infectious arteritis in the presence of bacteremia.[13] Skin flora, breaks in sterile technique, or remote infection may lead to the seeding of vascular structures after intervention. In addition, surgical and cardiologic experience has identified factors associated with an increased likelihood of bacteremia after stenting. Prolonged procedure time, repeated use of indwelling sheaths within 24 hours, repeated femoral access within 7 days, and puncture site hematoma have been implicated as inciting infection.[5] There is no consensus regarding infection rate after PTRAS, or any angioplasty procedure for that matter. There also are no strict guidelines regarding antibiotic prophylaxis for patients undergoing endovascular therapies; we recommend antibiotic prophylaxis for any such procedure, particularly in the presence of an indwelling catheter.

In addition to the complex infectious process, this case is unique in that normalization of renal function after intervention in this normotensive patient was unexpected. Our considerable institutional experience suggests that retrieval of renal function by operative means in patients with ischemic nephropathy is favorably influenced by four variables: (1) an abrupt onset of renal insufficiency, (2) bilateral occlusive disease, (3) radiographically demonstrated normal renal arteries distal to the obstructive lesion, and (4) severe and difficult-to-control hypertension.[14] Our patient had acute renal dysfunction in combination with renal artery stenosis involving a solitary kidney and a normal distal renal artery. Interestingly, hypertension was never a clinical feature of the patient's presentation. The absence of hypertension has been a strong negative predictor of renal salvage after intervention of any type in our experience; we have not observed a similar situation.

Mycotic processes involving the renal artery necessitate aggressive pursuit of the diagnosis via imaging studies, and aortography (both anteroposterior and lateral) is essential in planning revascularization. Once identified, the goal of therapy should be aimed at organismal eradication, which usually requires arterial and soft tissue debridement, and appropriate antibiosis. In addition, revascularization through noninfected planes typically requires extraanatomic bypass, whether for renal or limb salvage. These vexing cases frequently require individualized therapy that depends on the extent of arterial involvement, degree of organismal virulence, and overall patient status. Long-term antibiotic therapy is indicated.

This case was complicated by multiple factors, including a solitary kidney, MRSA infection, aortic involvement, and a lack of autogenous conduit. In addition, occlusive disease involving the celiac artery made hepatorenal bypass a poor option. Autotransplantation of the kidney to the pelvis / iliac vessels also was a poor option in our patient because of interrupted aortic flow. Axillobifemoral bypass followed by supraceliac aorta–to–renal artery bypass with polytetrafluoroethylene and subsequent proximal renal artery and aortic resection was performed to allow control of sepsis, maintenance of renal function, and limb salvage.

Despite taking appropriate precautions, we may still be confronted with this complex problem. Endovascular infections after PTRAS have been reported rarely, but with the increasingly liberal application of PTRAS nationwide, more cases are likely to arise. It thus becomes imperative for interventionalists performing these procedures to be aware of this potential complication. Strict sterile technique, antibiotic prophylaxis, and elimination of potential sources of periprocedural bacteremia may limit the occurrence of such arterial infections. When this uncommon complication is identified, it is important to expeditiously treat these patients to prevent uncontrolled sepsis, kidney loss, and death.

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